

TRENCH ISOLATION FOR INTEGRATED CIRCUITS

Abstract of the Disclosure

A dielectric film is formed by atomic layer deposition to conformally fill a narrow, deep trench for device isolation. The method of the illustrated embodiments 5 includes alternately pulsing vapor-phase reactants in a string of cycles, where each cycle deposits no more than about a monolayer of material, capable of completely filling high aspect ratio trenches. Additionally, the trench-fill material composition can be tailored by processes described herein, particularly to match the coefficient of thermal expansion (CTE) to that of the surrounding substrate within which the trench is formed. Mixed 10 phases of mullite and silica have been found to meet the goals of device isolation and matched CTE. The described process includes mixing atomic layer deposition cycles of aluminum oxide and silicon oxide in ratios selected to achieve the desired composition of the isolation material, namely on the order of 30% alumina and 70% silicon oxide by weight.

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